Comparing Regional Classifications for Real Estate Portfolio Diversification

*Emil E. Malizia**
*Robert A. Simons***

Abstract. **Considerable recent attention has been devoted to constructing improved spatial divsersification categories based on the economic characteristics of areas. This research compares Salomon Brothers' regional classification system to U.S. regions and the FRC regions using economic indicators related to real estate demand. Salomon's classification is shown to be the superior classification for reducing the variation of demand-side indicators. Several of Salomon's regions have higher internal variability than the U.S. as a whole and should be reconfigured. Spatial diversification systems may be improved generally by considering noncontiguous diversification criteria based on the economic fundamentals of metro areas and specifically by introducing metro-area size categories.**

Introduction

Regional diversification of real estate portfolios has been shown to provide benefits to investment managers by reducing the unsystematic risk associated with the fluctuation of portfolio returns [1, 5, 6, 7, 12, 13]. The two most important elements of portfolio construction include the creation of homogeneous categories, in this case geographic areas (as opposed to product types), and the coefficient of correlation between categories.

The issue of correlation between geographic categories has been widely addressed [1, 5, 6, 7, 13]. Research by Salomon Brothers reveals correlations among regional groupings that suggest the potential for benefits through portfolio diversification [5, 6]. Specifically, a recent Salomon study which applies shift-share to analyze metro-area employment from 1976 to 1989 for the large metro areas concludes that the Salomon regional classification system offers a reasonable basis for diversification given by the relatively low correlations among the eight regions' competitive effects [5].

In contrast to research conducted on correlation between categories, the issue of homogeneity of classification categories has not been addressed adequately. If real estate performance data were available, the covariation between categories would only be deemed meaningful when between-group covariance was significantly greater than with-group variation in performance. In other words, only relatively homogeneous categories that are distinctly different are useful diversification categories. The homogeneity of categories is an important evaluation criterion because greater homogeneity,

*Real Estate and Economic Development, Department of City and Regional Planning, The University of North Carolina-Chapel Hill, CB #3140 New East Building, Chapel Hill, North Carolina 27599-3140.
**Urban Studies, Planning and Development, Department of Urban Studies, Maxine Levin College of Urban Affairs, Cleveland State University, Cleveland, Ohio 44115.
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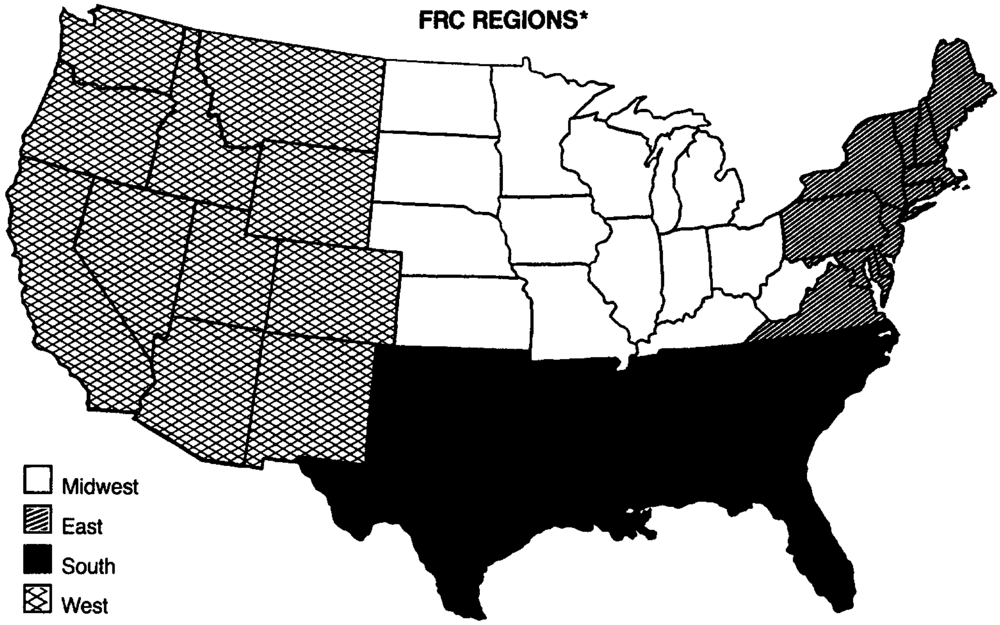
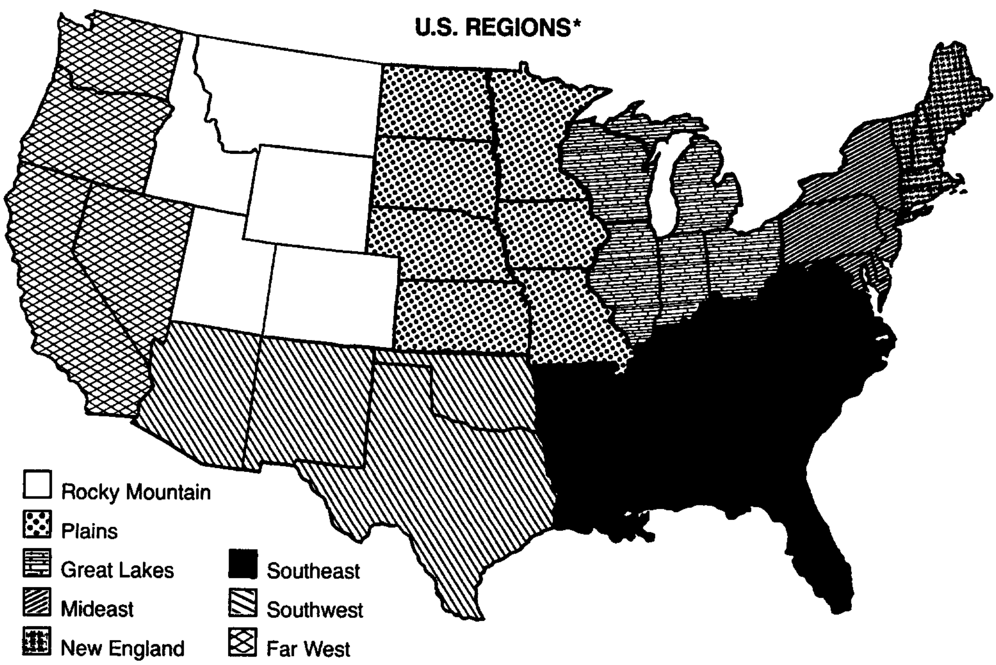
Exhibit 1
FRC and U.S. Region Configurations





*Alaska and Hawaii not included.
Source: Derived by the authors from data provided by the Frank Russell Company and the U.S. Department of Commerce, Bureau of Economic Analysis.

equivalent to lower internal variation within each category, allows more meaningful separation of investment groupings, and therefore serves to enhance the potential benefits of diversification. We use homogeneity as the criterion to evaluate alternative regional classification schemes, including the one proposed by Salomon.

Salomon Brothers currently publishes real estate demand and supply indicators for ninety-seven large metropolitan areas and for eight regions (New England, Mid-Atlantic Corridor, Industrial Midwest, Farmbelt, Old South, Mineral Extraction, Northern California, and Southern California) [14]. The regional classification scheme is based on research which analyzed the 1973–87 ex-post performance of commercial properties owned by Prudential [6]. The classification was finalized using judgments about historically recognized regional differences and county-level analysis of long-term real estate trends. The Salomon regions (Exhibit 1) are supposed to be economically homogeneous as well as geographically contiguous.

The thrust of our research is to compare the Salomon classification system to two other regional systems: the four major regions (East, Midwest, South and West), hereafter called the FRC regions, which had been researched previously with NCREIF data [7, 12) and the eight administrative regions (New England, Mideast, Great Lakes, Plains, Southeast, Southwest, Rocky Mountains, and Far West) used by the Bureau of Economic Analysis, referred to as the U.S. Regions shown in Exhibit 2. We use the standard deviation of three demand-side indicators over four time periods as a proxy for real estate risk and do not consider indicators of supply. The results given in a later section indicate that the eight-region Salomon classification offers greater diversification benefits than both the FRC regions and the U.S. Regions. Furthermore, the analysis shows that two Salomon regions exhibit an undesirably low degree of internal homogeneity and should be reconfigured.

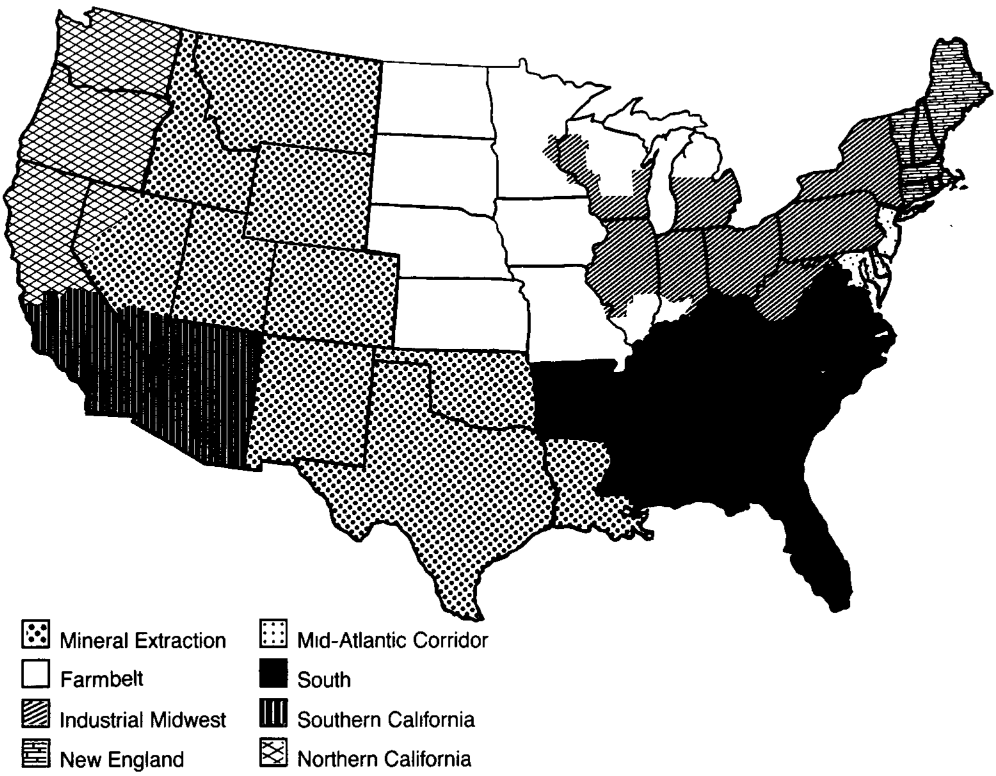
Subsequently, we address a potential direction for future work on spatial classification systems that may offer additional diversification benefits. We make an effort to improve spatial diversification categories by analyzing the noncontiguous criteria of metro-area size and metro/non-metro status.

This research has practical implications for investment managers by providing ideas about reducing unsystematic risk through spatial portfolio diversification. The evaluation of regional categories is important because investment managers with institutional clients are pursuing more sophisticated analysis of market risk. Most accept the possibility of diversification within the real estate asset class. Some of the larger equity players are testing groupings of locations and/or property types to derive diversification categories relevant for managing existing portfolios or forming new ones [8, 11].

The Data Set and Measures

The data analyzed in this research are from the 1988 data set of the Bureau of Economic Analysis, Regional Economic Information System. The data set was culled to include employment, total personal income, and population for 1969, 1979, 1982, 1983, and 1987 for all counties in the United States (or county-level data units according to BEA). To these data, we added the standard census regional and subregional geographic categories, a regional classification variable, and a variable that classified each county based on its metro or non-metro status and, for each metro county, the size of its metro

Exhibit 2
Salomon Brothers' Economic Geography of the United States



Note: Hawaii is in the Southern California category. Alaska is in Mineral Extraction.
Source: Salomon Brothers.

area. Metro areas were categorized into four strata on the basis of 1987 population (under 0.5 million, 0.5 to 1.0 million, 1.0 to 2.0 million, and over 2.0 million).

The entire data set included 18,180 observations and 27 variables. All cases with incomplete data or disclosure suppressions were deleted. Alaska and Hawaii were removed from the data set primarily for these reasons.

To verify the accuracy of the data set, annual rates of change (ARC) and selected standard deviations for total personal income and population published by Garnick [2, 3, 4] were successfully replicated. The statistical approach uses county-by-county data, which differs from Garnick's region-by-region approach. For standard deviation, the squared difference between the county ARC and the weighted average ARC for the region (as opposed to the arithmetic average of the sum of the ARCs) was used in the calculations.

Because property-specific performance data are not available to the authors, the research focuses on variables measured at the county level that are believed to drive the demand for space, namely employment by place of work, total personal income and population, both by place of residence. Employment is the most frequently used indicator of demand for commercial real estate [1, 5, 6] because it is closely associated with expansion or contraction in the amount of commercial space demanded in the market. Holding supply constant, an increase in employment should be positively associated with effective rents and real estate returns. Like population, employment is a real variable that facilitates intertemporal comparisons. The four time periods include 1969–79 and 1979–87. The more recent period is subdivided into two equal parts—a contraction phase from 1979–83 and an expansion phase during 1983–87. By examining longer term secular trends compared at similar points in the business cycle, the demand-side variables should reflect differences in intercounty space demand and may act as a proxy for that portion of property-level return attributable to location.

The standard deviation of each variable is treated as a measure of risk and internal homogeneity within each category. The lower the standard deviation, the lower internal variability (greater homogeneity) and the more appropriate the regional category. To facilitate analysis of this large body of results, each region's standard deviation is normed by the U.S. total as shown in the last column of most tables. Values over 1.0 indicate categories with more internal variability than the U.S. while values less than one indicate less variability. Twelve tables (three demand proxies times four time periods) are prepared. Exhibit 3 showing employment for the 1979–87 period provides an example of this information. The other eleven tables are included in the Appendix.

Exhibit 3 shows change in employment for the United States, and the individual FRC, U.S. and Salomon Regions. From left to right, the reader will observe the number of counties, mean annual growth rate, standard deviation, and the normalizing statistic of the region's standard deviation divided by the average standard deviation of the entire United States.

Focusing on regional standard deviation as a measure of categorical homogeneity, the overall national figure for this time period was 0.022. Two of the FRC regions, East (0.018) and Midwest (0.016) exhibited a lower standard deviation than the U.S. as a whole. These two regions, therefore, exhibit more homogeneity, and are desirable from a regional categorization perspective. The other two FRC regions had both a smaller number of counties and a higher standard deviation than the nation, showing that. greater disaggregation in itself is not sufficient to ensure greater homogeneity.

Of the eight U.S. Regions, five (New England—0.014, Mideast—0.017, Great Lakes

Exhibit 3
Mean Annual Growth Rate and Standard Deviation for Employment by County, 1979 to 1987

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.019	0.022	1.000
FRC REGIONS				
East	350	0.019	0.018	0.818
Midwest	1229	0.008	0.016	0.727
South	1086	0.024	0.025	1.136
West	413	0.026	0.027	1.227
U.S. CENSUS REGIONS				
New England	67	0.025	0.014	0.636
Mideast	178	0.016	0.017	0.773
Great Lakes	436	0.007	0.014	0.636
Plains	618	0.011	0.018	0.818
Southeast	1035	0.024	0.025	1.136
Southwest	379	0.024	0.025	1.136
Rocky Mountains	215	0.018	0.028	1.273
Far West	150	0.026	0.021	0.955
SALOMON REGIONS				
Farmbelt	750	0.006	0.015	0.682
Industrial Midwest	484	0.008	0.017	0.773
Mid-Atlantic	72	0.022	0.018	0.818
Mineral Extraction	654	0.018	0.024	1.091
New England	66	0.025	0.014	0.636
Northern California	124	0.024	0.019	0.864
Southern California	30	0.031	0.022	1.000
South	898	0.026	0.025	1.136

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

—0.014, Plains—0.018, and Far West—0.21) exhibited lower standard deviations than the nation as a whole, indicating that they were an improvement over no spatial diversification. Three regions were less homogeneous than the nation.

For the Salomon Regions, five were superior to the national standard: Farmbelt, Industrial Midwest, Mid-Atlantic, New England, and Northern California, and one region, Southern California, was equivalent. Two regions, Mineral Extraction and the South, were less homogeneous.

Statistical Procedures and Results

Comparing Diversification Classification Schemes

In order to evaluate the three schemes (FRC, U.S. Regions, and Salomon Regions), each is compared to the others and to the nation as a whole. Two tests are used, an F-test and the less familiar Wilcoxon signed-rank test.

Exhibit 4
Variances of FRC, U.S. CENSUS and SALOMON REGIONS for Employment by County, 1979 to 1987

Geographic Area	Number	Standard Deviation	Variance
UNITED STATES	3078	0.022	0.000484
FRC REGIONS			
East	350	0.018	0.000324*
Midwest	1229	0.016	0.000256*
South	1086	0.025	0.000625
West	413	0.027	0.000729
U.S. CENSUS REGIONS			
New England	67	0.014	0.000196*
Mideast	178	0.017	0.000289*
Great Lakes	436	0.014	0.000196*
Plains	618	0.018	0.000324*
Southeast	1035	0.025	0.000625
Southwest	379	0.025	0.000625
Rocky Mountains	215	0.028	0.000784
Far West	150	0.021	0.000441
SALOMON REGIONS			
Farmbelt	750	0.015	0.000225*
Industrial Midwest	484	0.017	0.000289*
Mid-Atlantic	72	0.018	0.000324*
Mineral Extraction	654	0.024	0.000576
New England	66	0.014	0.000196*
Northern California	124	0.019	0.000361*
Southern California	30	0.022	0.000484
South	898	0.025	0.000625

Notes: Data exclude Alaska, Hawaii and offshore territories.
*statistically significant at 0.01
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

The F-test is used to determine whether each region had a significantly lower standard deviation than the nation as a whole for employment growth in the 1979–1987 period. To accomplish this test, the variances of each region were computed (Exhibit 4). The hypothesis is that no difference exists between variances; specifically, that the ratio of regional variance to total U.S. variance equals one. The test-statistic is an F-ratio with degrees of freedom equal to one less than the number of counties in the region or the nation. Since the objective is to establish categories that are more homogeneous, the relevant test is one-tailed with critical values less than one. For example, the critical value at the 0.01 level of significance for 120 degrees of freedom in the numerator for the region and approximately infinite degrees of freedom in the denominator for the entire U.S. is 0.758. Therefore, only regions with variances below 0.000367 would be *significantly* more homogeneous than the U.S. as a whole which has a variance of 0.000484.

Applying the F-test to the variances shown in Exhibit 4, only two FRC variances are significantly below the U.S. level at the 1% significance level. Thus, only the FRC regions in the eastern half of the country are more homogeneous than the U.S.

The U.S. Regions' F-tests indicate that four of eight regions (New England, Mideast, Great Lakes and Plains) are significantly less variable than the nation.

For the Salomon Regions, five—New England, Mid-Atlantic, Industrial Midwest, Farmbelt, and Northern California—are significantly less variable (more homogeneous) than the nation as a whole: the remaining three regions are not. On this basis, the Salomon categories appear to be superior to the other systems for the employment demand proxy and the 1979–87 time period.

The relative superiority of the three regional schemes is also tested using the Wilcoxon signed-rank test, a nonparametric statistical procedure for comparing matched-pair data [9]. With this technique, we use the arithmetic average of each system's standard deviation normalized by the national figure to compare the FRC, Salomon, and U.S. regional classifications. Each of four time periods and three space demand proxies are considered one observation for a total of twelve pairwise comparisons of the classifications.

The FRC is expected to be superior to the nation as whole (e.g., no diversification). The U.S. Regions are likely to perform better than FRC. In turn, the U.S. Regions are expected to have more intra-regional variation and therefore be less desirable than the Salomon Regions. The Salomon categories should perform better because this regional classification emphasizes functional and economic realities more than geographic or administrative boundaries.

Exhibit 5
Summary of Regional Classification Performance Relative to the U.S. Standard Deviation

	1969 to 1979	1979 to 1987	1979 to 1983	1983 to 1987
Employment				
FRC	1.03	0.98	0.98	0.96
U.S. REGIONS	1.01	0.92	0.92	0.83
SALOMON	0.99	0.88	0.85	0.77
Total Personal Income				
FRC	0.99	0.92	0.87	1.01
U.S. REGIONS	0.91	0.86	0.85	0.89
SALOMON	0.89	0.84	0.77	0.83
Population				
FRC	0.99	0.95	0.89	0.97
U.S. REGIONS	0.98	0.91	0.87	0.90
SALOMON	0.98	0.89	0.78	0.86

Note: The data in the table represent the arithmetic average of each subregion's standard deviation/U.S. standard deviation. The national figure is 1.00.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit 5 contains the data used to test the classification systems. The Wilcoxon procedure [9, p. 419] uses the paired differences of the systems as well as their ranked sums.

Using $\alpha=0.05$ with a critical z-statistic of 1.64, the resulting scores for the three pairwise comparisons are as follows:

Expected Result	z-score
FRC > Nation	2.01*
U.S. Regions > FRC	3.07*
Salomon > U.S. Regions	2.93*

*Statistically significant at $\alpha=0.05$, critical $z=1.64$.

Applying the transitive law, we find that over all time periods and demand proxies, the Salomon classification system offers the highest degree of intra-regional homogeneity. The Salomon system is superior because it has eight regions rather than four and was devised based on past economic relationships, rather than other political categorizations strictly following state lines.[1]

Possible Modifications of the Salomon System

As currently configured, the Salomon classification contains two categories that exhibit greater internal variation than the U.S. as a whole in terms of their high standard deviations for employment from 1979 to 1987. These regions are South (0.025) and Mineral Extraction (0.027). In addition, Southern California had the same standard deviation as the nation (0.022).

A closer look at the standard deviations of the employment variable of these three regions over all time periods is warranted:

	Standard Deviation			
	1969–1978*	1979–1987	1979–1982	1983–1987
U.S.	0.022	0.022	0.027	0.031
South	0.023	0.025	0.028	0.030
Mineral Extraction	0.031	0.024	0.033	0.031
Southern California	0.019	0.022	0.022	0.024

*Mid-Atlantic (0.028) and Northern California (0.025) also scored higher than the U.S. as a whole for this period.

The analysis of standard deviation over time allows comparison of the data across business cycles. Southern California generally performs better than the nation as a whole. The Mineral Extraction region and South region consistently exhibit higher standard deviations and do not appear to be robust as distinct economic regions. The boundaries of these regions should be reconfigured by comparing employment growth or other demand indicators in counties along the regions' borders with those demand indicators in neighboring counties of adjacent regions.

Another suggestion for reconfiguring the categories would be to look for economic similarities that do not require geographic contiguity. For example, considering the high percentage of Hispanic population, Miami may have more in common with Southern California or South Texas than with the balance of the Salomon South region. As many such comparisons are possible as there are economic factors. Using diversification criteria which lead to noncontiguous categories is developed more fully in the next section.

Suggestions for Improving Spatial Diversification Categories

The regional science, urban geography, economic development, and human ecology literatures yield many insights about the structure and functions of metro economies where institutional real estate is located. Yet, this spatial theory base is largely absent from the work to date on spatial real estate diversification. Further research should be firmly grounded in this theory to conduct proper assessments of real estate market risk.

Spatial theory clearly suggests that nodal regions, which are approximated either by metro areas or by metro areas and adjacent non-metro counties that comprise the BEA economic areas, are superior to cities, counties, states, or multistate regions when examining economic structure and performance over time. Metro areas with similar linkages to the global economy should perform similarly in the future. Careful studies of metro economies should yield relatively homogeneous diversification groupings of metro areas that are neither contiguous nor proximate.

With respect to the Salomon categories, Shulman and Hopkins classify fifty-three metro areas by the concentration of employment in seventeen different industrial groupings that represent the different functional specializations of these areas. The authors argue that this pure economic dimension should be added to their eight geographic regions in developing portfolio strategies [13]. Although their suggestion has considerable merit, functional specialization as reflected in the industrial mix of a metro economy is but one of many structural factors considered important in the spatial theory literatures. In addition to functional specialization of metro economies, other factors deserve attention, including productive efficiency, innovation potential, diversity, dominance, centrality, and business climate. Like industry mix, these factors influence near-term employment and income growth, but they also appear to be better predictors of the long-term demand for space.[2]

Metro Area Status and Size

One readily identifiable measure that is associated with several structural factors listed above is metropolitan area size. In the past, institutional players have preferred to invest in the largest metropolitan areas, based in part on the belief that these markets operate more effectively in absorbing demand for space. Also, portfolio managers are motivated to invest in areas with which they are most familiar and to enjoy the savings reflected in economies of information and property management. Yet the belief that larger markets

Exhibit 6
Mean Annual Growth Rate and Standard Deviation for Employment by Metro, Non-Metro and All Counties, 1979 to 1987

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Region S.D./ U.S. S.D.*
UNITED STATES (all)	3078	0.019	0.022	1.000
Non-Metro	2349	0.009	0.018	0.818
Metro	729	0.021	0.022	1.000
Less than 0.5 million	349	0.016	0.019	0.864
0.5 to 1.0 m	160	0.022	0.019	0.864
1 to 2 m	109	0.025	0.021	0.955
2+ million	111	0.021	0.031	1.409
SALOMON REGIONS (Non-Metro)				
Farmbelt	683	0.004	0.014	0.636
Industrial Midwest	284	0.004	0.014	0.636
Mid-Atlantic	14	0.027	0.013	0.591
Mineral Extraction	549	0.006	0.021	0.955
New England	39	0.030	0.015	0.682
Northern California	82	0 012	0.018	0.818
Southern California	17	0.026	0.025	1.136
South	681	0.012	0.019	0 864
SALOMON REGIONS (Metro)				
Farmbelt	67	0 010	0.017	0.773
Industrial Midwest	200	0.009	0.018	0.818
Mid-Atlantic	58	0.021	0.019	0.864
Mineral Extraction	105	0.022	0.024	1.091
New England	27	0.024	0.012	0.545
Northern California	42	0.025	0.014	0.636
Southern California	13	0.031	0.011	0.500
South	217	0.032	0.025	1.136

Notes: *Region averages compared with U.S. total standard deviation. Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

have the highest risk-adjusted rate of return may not be correct. As shown below, the largest areas do not appear to be the most attractive when considering both employment growth and volatility.

To illustrate potential improvements in developing spatial diversification categories, the data set was run using the size of the metro area and metro or non-metro status for all counties and metro/non-metro status for the Salomon categories as shown in Exhibit 6. We examine mean employment growth rate as a proxy for return as well as standard deviation as a proxy for risk. Following Corgel and Gay [1] who found unsystematic variation in employment growth by industry in the largest thirty metro areas, we expect to achieve spatial diversification gains by analyzing size and metro status. Unlike that study, we do not attempt to construct geographic portfolios or define an efficient frontier.

Comparing mean growth and standard deviation for each of the eight combined Salomon regions in Exhibit 3 with the means and standard deviations for its metro/non-metro components in Exhibit 6, we find nearly all disaggregated regions perform better on either risk, return, or both when metro status is recognized. If we assume that the investing had taken place during the 1979–87 period and that property-level performance followed the county-level growth and deviation indicators, then risk would have been reduced *and* return improved if portfolio managers had invested in areas scoring "yes" for both risk and return, namely Metro Farmbelt, Non-metro Mid-Atlantic, Non-metro New England, Metro Northern California, and Metro Southern California.[3]

	Better Than Combined Category For:					
	METRO			NON-METRO		
Salomon Region	Risk	Return	Both*	Risk	Return	Both*
Farmbelt	+	+	Y	+	–	N
Ind. Midwest	–	+	N	+	–	N
Mid-Atlantic	–	–	N	+	+	Y
Mineral Extraction	+	+	Y	+	–	N
New England	+	–	N	+	+	Y
North California	+	+	Y	+	–	N
Southern California	+	+	Y	+	–	N
South	–	+	N	+	–	N

*Y = Yes; N = No

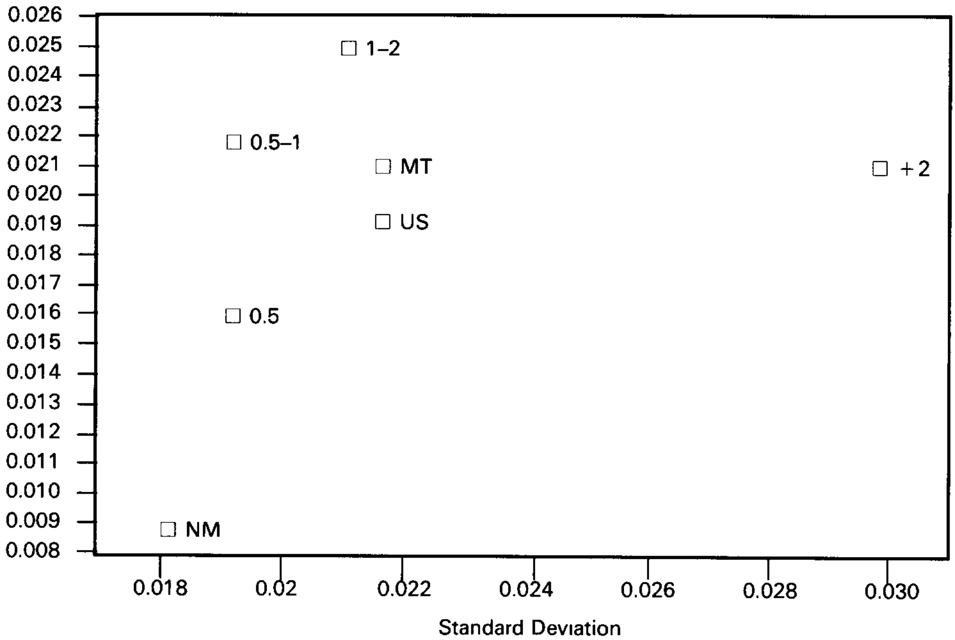
This analysis supports the conventional wisdom of favoring metro areas while also recognizing exurban areas within higher density regions such as New England and Mid-Atlantic as locations that may offer the most attractive investment opportunities. More generally, the analysis illustrates that the portfolio may benefit from intra-regional diversification by metro/non-metro status.

To consider the trade-offs between risk and return based on metro-area status and size, Exhibit 7 contains plots of the mean employment growth rate and standard deviation, the proxies for return and risk, for the nation as a whole, metro and non-metro areas, and the four size categories of metro areas as given in Exhibit 6. Of course, the implications of the results in Exhibits 6 and 7 will depend upon the preferences of investment managers. What can be said unequivocally is that metro areas represent a more favorable aggregate unit than the U.S. as a whole when utilizing county employment in the 1979–87 period as a demand proxy.

Size strata of metropolitan areas may also offer attractive diversification categories. As Exhibit 7 indicates, the smallest metro areas have inferior growth rates. Metro areas over 2.0 million have a much higher standard deviation (0.031 to 0.022) but about the same return (2.1%) as all metro areas. The best opportunities appear to lie in medium-sized metropolitan areas from 0.5 to 2.0 million where the return is greater and the risk smaller than for all metro areas combined.

This analysis leads to two conclusions. First, given the competition for investment-grade properties located in the largest metro areas, investment managers should consider looking at smaller metro areas as targets for potentially better performance. Second, categorizing investments by metro-area size may provide additional portfolio diversification benefits.

Exhibit 7
Rate of Return and Standard Deviation for the Nation by Metropolitan Area Size for Employment, 1979–1987



Key:
Region

U.S.—All	U.S.
Non-Metro	NM
Metro	MT
<0.5 million	0.5
0.5–1 million	0.5–1
1–2 million	1–2
2 million	+2

Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Conclusions and Future Research

The Salomon regional classification, which recognizes similar economic activities and conditions, generates somewhat less intra-regional variability among contiguous regions and therefore is more desirable than alternative classification schemes with geographically contiguous areas. Because Salomon's Mineral Extraction and South categories perform consistently below the U.S. average, the boundaries of those regions should be rethought. Metro-area size and status appear to be suitable factors to consider for diversification.

Future research should emphasize the economic roles of metro areas that are emerging in the global economy more than their economic history or geographic location to establiish homogeneous diversification categories. This research is likely to suggest that noncontiguous metro-area groupings based on similar economic fundamentals offer more efficient ways to reduce demand-side volatility than contiguous regional groupings. Porfolio managers, who are often co-located at corporate headquarters with top management and who enjoy good lines of communication to asset managers, can easily work with noncontiguous categories. They should begin formulating diversification strategies with relatively stable and homogeneous groupings of targeted metro areas.

Notes

[1]This research does not aim to determine the optimum number of diversification categories. Obviously, if portfolio management realities were not an issue, a larger number of categories could be devised to yield greater homogeneity. For this reason, any scheme with a larger rather than smaller number of categories would be expected to be superior based solely on scale and holding all other factors constant.

[2]Together with studies of development restrictiveness and socioeconomic factors that affect long-term supply, such metro-level research should result in better predictions of real estate performance and market risk. Building on work completed for MONY Real Estate [10], the senior author is currently developing noncontiguous metro-area groupings using these fundamental demand and supply factors.

[3]Although metropolitan Mineral Extraction area was also an improvement over the combined regional figure, it has a higher standard deviation than the U.S. as a whole and should be reconfigured.

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Exhibit A1
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Total Personal Income by County, 1969 to 1979

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.102	0.025	0.248	1.000
FRC REGIONS					
East	350	0.087	0.026	0.301	1.040
Midwest	1229	0.097	0.020	0 204	0.800
South	1086	0.121	0.022	0.184	0.880
West	413	0.114	0.031	0.271	1.240
U.S. CENSUS REGIONS					
New England	67	0.089	0.017	0.194	0.680
Mideast	178	0.084	0.022	0.257	0.880
Great Lakes	436	0.094	0.018	0.188	0.720
Plains	618	0.103	0.017	0.166	0.680
Southeast	1035	0.117	0.020	0.169	0.800
Southwest	379	0.127	0.027	0.213	1.080
Rocky Mountains	215	0.128	0.035	0.276	1.400
Far West	150	0.110	0.026	0.241	1.040
SALOMON REGIONS					
Farmbelt	750	0.105	0.016	0.156	0.640
Industrial Midwest	484	0.093	0.017	0.188	0.680
Mid-Atlantic	72	0.083	0.031	0.372	1.240
Mineral Extraction	654	0.125	0.029	0.235	1.160
New England	66	0.090	0.017	0.192	0.680
Northern California	124	0.112	0.026	0.232	1.040
Southern California	30	0.110	0.022	0.199	0.880
South	898	0.117	0.020	0.169	0.800

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A2
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Total Personal Income by County, 1979 to 1987

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.080	0.025	0 307	1.000
FRC REGIONS					
East	350	0.086	0.019	0.225	0.760
Midwest	1229	0.065	0.017	0.258	0.680
South	1086	0.087	0.025	0.291	1.000
West	413	0.087	0.031	0.358	1 240
U.S. CENSUS REGIONS					
New England	67	0.095	0.014	0.145	0.560
Mideast	178	0.082	0.019	0.235	0.760
Great Lakes	436	0.063	0.013	0.202	0.520
Plains	618	0.069	0.020	0.296	0.800
Southeast	1035	0.088	0.025	0.285	1.000
Southwest	379	0.084	0.028	0.331	1.120
Rocky Mountains	215	0 074	0.029	0.394	1.160
Far West	150	0.088	0.024	0.277	0.960
SALOMON REGIONS					
Farmbelt	750	0.065	0.017	0.269	0.680
Industrial Midwest	484	0.066	0.016	0.246	0.640
Mid-Atlantic	72	0.089	0.019	0.216	0.760
Mineral Extraction	654	0.077	0.027	0.348	1.080
New England	66	0.094	0.014	0.046	0.560
Northern California	124	0.083	0.022	0.066	0.880
Southern California	30	0.094	0.027	0.286	1.080
South	898	0.091	0.025	0 272	1.000

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A3
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Total Personal Income by County, 1979 to 1983

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.087	0.038	0 443	1.000
FRC REGIONS					
East	350	0.092	0.021	0.224	0.553
Midwest	1229	0.063	0.031	0.489	0.816
South	1086	0.103	0.035	0.336	0.921
West	413	0.093	0.045	0.485	1.184
U.S. CENSUS REGIONS					
New England	67	0.099	0.015	0.149	0.395
Mideast	178	0.089	0.021	0.231	0.553
Great Lakes	436	0.060	0.020	0.338	0.526
Plains	618	0.071	0.041	0.580	1.079
Southeast	1035	0.097	0.031	0.316	0.816
Southwest	379	0.111	0.043	0.390	1.132
Rocky Mountains	215	0.098	0.052	0.529	1 368
Far West	150	0.092	0.034	0.374	0.895
SALOMON REGIONS					
Farmbelt	750	0.066	0.036	0.547	0.947
Industrial Midwest	484	0.066	0.023	0.345	0.605
Mid-Atlantic	72	0.096	0.020	0 204	0.526
Mineral Extraction	654	0.107	0.046	0.428	1.211
New England	66	0.099	0.015	0.150	0.395
Northern California	124	0.089	0.032	0.357	0.842
Southern California	30	0.096	0.031	0.329	0.816
South	898	0 097	0.031	0.317	0.816

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V may contain rounding error.
Source: Derived by the authors from data provided by the U.S Department of Commerce, Bureau of Economic Analysis.

Exhibit A4
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Total Personal Income by County, 1983 to 1987

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.074	0.029	0.398	1.000
FRC REGIONS					
East	350	0.080	0.021	0.267	0.724
Midwest	1229	0.066	0.024	0.367	0.828
South	1086	0.071	0.031	0.443	1.069
West	413	0.080	0.041	0.508	1.414
U.S. CENSUS REGIONS					
New England	67	0.090	0.016	0.176	0.552
Mideast	178	0.076	0.020	0.267	0.690
Great Lakes	436	0.066	0.016	0.239	0.552
Plains	618	0.068	0.029	0.427	1.000
Southeast	1035	0.079	0.028	0.348	0.966
Southwest	379	0.057	0.033	0.570	1.138
Rocky Mountains	215	0.050	0.033	0.657	1.138
Far West	150	0.084	0.031	0.366	1.069
SALOMON REGIONS					
Farmbelt	750	0.064	0.027	0.429	0.931
Industrial Midwest	484	0.066	0.018	0.278	0.621
Mid-Atlantic	72	0.082	0.021	0.260	0.724
Mineral Extraction	654	0.048	0.031	0.660	1.069
New England	66	0.090	0.016	0.176	0.552
Northern California	124	0.077	0.028	0.367	0.966
Southern California	30	0.092	0.027	0.296	0.931
South	898	0.085	0.025	0.289	0.862

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A5
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Population by County, 1969 to 1979

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.011	0.018	1.487	1.000
FRC REGIONS					
East	350	0 003	0.017	6.144	0.944
Midwest	1229	0.005	0.012	2.488	0.667
South	1086	0.020	0.019	0.921	1.056
West	413	0.021	0.023	1.091	1.278
U.S. CENSUS REGIONS					
New England	67	0.005	0.014	2.777	0.778
Mideast	178	0.001	0.015	26.367	0.833
Great Lakes	436	0.004	0 013	3.211	0 722
Plains	618	0.005	0.013	2.349	0.722
Southeast	1035	0.018	0.016	0.881	0.889
Southwest	379	0.024	0.022	0.902	1.222
Rocky Mountains	215	0.027	0.025	0.923	1.389
Far West	150	0.018	0.023	1.251	1.278
SALOMON REGIONS					
Farmbelt	750	0.006	0.013	2.180	0.722
Industrial Midwest	484	0.004	0.012	3.010	0 667
Mid-Atlantic	72	0.000	0.022	0.000	1.222
Mineral Extraction	654	0.022	0 022	1.000	1.222
New England	66	0 005	0.014	2.690	0.778
Northern California	124	0.019	0.023	1.250	1.278
Southern California	30	0.021	0.019	0.900	1.056
South	898	0.019	0.016	0 950	0.889

Notes: Data exclude Alaska, Hawaii and offshore territories The C.V may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A6
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Population by County, 1979 to 1987

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.010	0.015	1.487	1.000
FRC REGIONS					
East	350	0.004	0.010	2.608	0.667
Midwest	1229	0.002	0.010	5.687	0.667
South	1086	0.018	0.017	0.971	1.133
West	413	0.020	0.020	0.986	1.333
U.S. CENSUS REGIONS					
New England	67	0.005	0.008	1.701	0.533
Mideast	178	0.003	0.010	3.774	0.667
Great Lakes	436	0.001	0.007	8.487	0.467
Plains	618	0.004	0.012	3.139	0.800
Southeast	1035	0.014	0.015	1.076	1.000
Southwest	379	0.023	0.021	0.902	1.400
Rocky Mountains	215	0.015	0.019	1.265	1.267
Far West	150	0.020	0.017	0.832	1.133
SALOMON REGIONS					
Farmbelt	750	0.002	0.011	4.463	0.733
Industrial Midwest	484	0.001	0.008	9.600	0.533
Mid-Atlantic	72	0.005	0.013	2.545	0.867
Mineral Extraction	654	0.019	0.019	1.029	1.267
New England	66	0.005	0.008	1.637	0.533
Northern California	124	0.017	0.015	0.916	1.000
Southern California	30	0.025	0.018	0.724	1.200
South	898	0.015	0.015	1.031	1.000

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A7
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Population by County, 1979 to 1983

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.011	0.018	1 676	1.000
FRC REGIONS					
East	350	0.002	0.009	3.997	0.500
Midwest	1229	0.001	0.011	8.766	0.611
South	1086	0.021	0.019	0.905	1.056
West	413	0.021	0.025	1.162	1.389
U.S. CENSUS REGIONS					
New England	67	0.003	0.009	2.959	0.500
Mideast	178	0.001	0.008	7.418	0.444
Great Lakes	436	−0.001	0.008	−14.478	0.444
Plains	618	0.005	0.013	2.806	0.722
Southeast	1035	0.015	0.015	1.050	0.833
Southwest	379	0.031	0.023	0.731	1.278
Rocky Mountains	215	0.023	0.027	1.134	1.500
Far West	150	0.020	0.022	1.063	1.222
SALOMON REGIONS					
Farmbelt	750	0.004	0.012	3.177	0.667
Industrial Midwest	484	0.000	0.008	0.000	0.444
Mid-Atlantic	72	0.003	0 011	3.689	0.611
Mineral Extraction	654	0.028	0.024	0.872	1.333
New England	66	0.003	0.009	3.024	0.500
Northern California	124	0.018	0 016	0.891	0.889
Southern California	30	0.024	0.016	0.690	0.889
South	898	0.015	0.016	1.056	0.889

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A8
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Population by County, 1983 to 1987

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.010	0.019	1.953	1.000
FRC REGIONS					
East	350	0.006	0.013	2.318	0.684
Midwest	1229	0.002	0.013	6.119	0.684
South	1086	0.014	0.021	1.503	1.105
West	413	0.019	0.027	1.425	1.421
U.S. CENSUS REGIONS					
New England	67	0.007	0.010	1.367	0.526
Mideast	178	0.004	0.012	3.092	0.632
Great Lakes	436	0.002	0.010	4.125	0.526
Plains	618	0.003	0.016	5.241	0.842
Southeast	1035	0.013	0.017	1.277	0.895
Southwest	379	0.015	0.029	1.881	1.526
Rocky Mountains	215	0.007	0.024	3.276	1.263
Far West	150	0.020	0.019	0.983	1.000
SALOMON REGIONS					
Farmbelt	750	0.001	0.014	14.998	0.737
Industrial Midwest	484	0.002	0.011	5.497	0.579
Mid-Atlantic	72	0.007	0.015	2.191	0.789
Mineral Extraction	654	0.010	0.025	2.568	1.316
New England	66	0.007	0.010	1.281	0.526
Northern California	124	0.015	0.017	1.131	0.895
Southern California	30	0.026	0.022	0.820	1.158
South	898	0.015	0.017	1.137	0.895

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A9
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Employment by County, 1969 to 1979

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.022	0.022	0.999	1.000
FRC REGIONS					
East	350	0.011	0.019	1.800	0.864
Midwest	1229	0.017	0.017	0.996	0.773
South	1086	0.031	0.025	0.802	1.136
West	413	0.037	0.029	0.787	1.318
U.S. CENSUS REGIONS					
New England	67	0.017	0.016	0.095	0.727
Mideast	178	0.007	0.018	2.447	0.818
Great Lakes	436	0.015	0.015	1.016	0.682
Plains	618	0.022	0.018	0.818	0.818
Southeast	1035	0.027	0.022	0.813	1.000
Southwest	379	0.039	0.029	0.769	1.318
Rocky Mountains	215	0.045	0.035	0.771	1.591
Far West	150	0.034	0.025	0.735	1 136
SALOMON REGIONS					
Farmbelt	750	0.021	0.017	0.836	0.773
Industrial Midwest	484	0.015	0.015	0.998	0.682
Mid-Atlantic	72	0.007	0.028	3.932	1.273
Mineral Extraction	654	0.037	0.031	0.822	1.409
New England	66	0.017	0.016	0.965	0.727
Northern California	124	0.034	0.025	0.741	1.136
Southern California	30	0 037	0.019	0 506	0.864
South	898	0.028	0.023	0.811	1.045

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A10
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Employment by County, 1979 to 1983

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.005	0.027	4.902	1.000
FRC REGIONS					
East	350	0.006	0.021	3.352	0.778
Midwest	1229	−0.012	0.020	−1.706	0.741
South	1086	0.017	0.030	1.749	1.111
West	413	0.014	0.035	2.571	1 296
U.S. CENSUS REGIONS					
New England	67	0.011	0.018	1.569	0.667
Mideast	178	0.003	0.020	5.895	0.741
Great Lakes	436	−0.016	0.018	−1.102	0.667
Plains	618	−0.002	0.019	−7.874	0.704
Southeast	1035	0.011	0.029	2.750	1.074
Southwest	379	0.027	0.029	1.100	1.074
Rocky Mountains	215	0.016	0.040	2.489	1.481
Far West	150	0.012	0.026	2.220	0.963
SALOMON REGIONS					
Farmbelt	750	−0.006	0.019	−2.968	0.704
Industrial Midwest	484	−0.013	0.020	−1.555	0.741
Mid-Atlantic	72	0.011	0.019	1.743	0.704
Mineral Extraction	654	0.022	0 033	1.520	1.222
New England	66	0.011	0.018	1.669	0.667
Northern California	124	0.011	0.024	2.239	0.889
Southern California	30	0.015	0.022	1.523	0.815
South	898	0.011	0.028	2.473	1.037

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.

Exhibit A11
Mean Annual Growth Rate, Standard Deviation and Coefficient of Variation for Employment by County, 1983 to 1987

Geographic Area	Number	Mean Rate of Growth	Standard Deviation	Coefficient of Variation	Region S.D./ U.S. S.D.
UNITED STATES	3078	0.032	0.031	0.971	1 000
FRC REGIONS					
East	350	0.033	0.022	0.656	0 710
Midwest	1229	0.028	0.027	0.971	0.871
South	1086	0.030	0.033	1.106	1 065
West	413	0.038	0.037	0.966	1 194
U.S. CENSUS REGIONS					
New England	67	0.039	0 015	0.381	0 484
Mideast	178	0 029	0.019	0.641	0.613
Great Lakes	436	0.030	0.021	0.697	0.667
Plains	618	0.024	0.029	1.202	0.935
Southeast	1035	0 037	0.031	0.834	1.000
Southwest	379	0.021	0.034	1 639	1.097
Rocky Mountains	215	0.020	0.032	1.629	1.032
Far West	150	0.041	0 026	0.649	0.839
SALOMON REGIONS					
Farmbelt	750	0.019	0 025	1.293	0.806
Industrial Midwest	484	0 030	0.021	0 716	0.677
Mid-Atlantic	72	0.033	0.022	0.671	0.710
Mineral Extraction	654	0.013	0.031	2.364	1 000
New England	66	0.040	0.015	0.375	0.484
Northern California	124	0.037	0.022	0.608	0.710
Southern California	30	0 047	0.024	0.517	0.774
South	898	0.040	0.030	0.732	0.968

Notes: Data exclude Alaska, Hawaii and offshore territories. The C.V. may contain rounding error.
Source: Derived by the authors from data provided by the U.S. Department of Commerce, Bureau of Economic Analysis.